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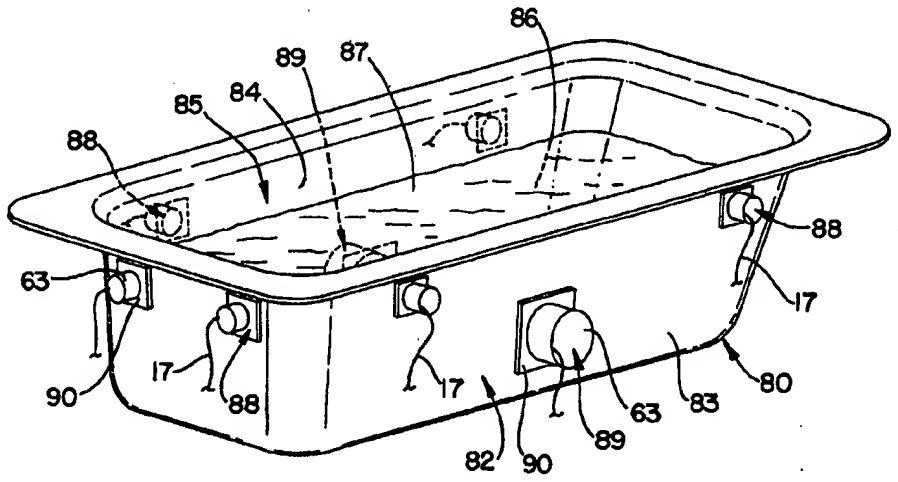


(57) Abstract

An entertainment and treatment system, comprising: a fixture (80) having a wall (82) forming a reservoir (85); a transducer (88, 89) mounted on an exterior surface (83) of the wall (82) for transmitting energy into the wall; and an excitation source (15) for energizing the transducer (88, 89), the fixture (80) forming an integral part of a loudspeaker (88, 89) in which the wall (82) transmits vibrations responsive to operation of the transducer (88, 89), the vibrations being emitted from an interior surface of the wall (82) into the reservoir (85). The system is preferably used with a body of water in the reservoir, having an upper surface defining a waterline (87). Vibrations in an audible range are emitted from the interior surface (84) of the wall above the waterline (87), but are perceived as being emitted from the upper surface of the water. Vibrations below the audible frequency range are emitted from the interior surface (84) of the wall (82) below the waterline (87) and into the water, creating a massage action.

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ACOUSTIC ENTERTAINMENT AND THERAPY SYSTEMS FOR WATER FIXTURES

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of acoustic and treatment systems in general, and in particular, to acoustic and treatment systems for bathrooms and bathroom water fixtures and fittings, and the like. More particularly, the invention relates to the field of acoustic and treatment systems which utilize, for example, common lavatory and plumbing fixtures, such as bath tubs, spas, whirlpools, sinks, shower stalls and toilets, as a sound producing apparatus.

2. Description of Related Art

A psychophysiosonic system with multisensory aids is disclosed in US 3,585,991, which simultaneously applies a number of stimuli to humans for therapeutic purposes involving audible and inaudible sound vibrations introduced into the interior of human beings by means of underwater projection, in combination with sensory stimulation. Sound stimuli are provided through separate headphones.

An integrated stereo and bathtub system is disclosed in US 4,575,882. A bathtub has speakers are mounted in apertures through and around the wall of the tab, above the level of the overflow outlet.

A therapeutic vibratory bath is disclosed in US 5,042,479, in which one person can supported on a sling and be immersed in the bath in a standing position. A hydrotherapy bath with a wave energy producing mechanism is disclosed in US 3,776,223.

An underwater system disclosed in DE 42 413 12 uses a number of lights and/or sound sources arranged relative the a water mass to allow light or sound to be transmitted in the water, responsive to a mind machine.

Sound systems for bathrooms and the like have been restricted to the placement of self contained loudspeakers in strategic locations throughout the bathroom, for example around the rim of a bathtub or in a shower stall. The only special provision undertaken for such a loudspeaker is a waterproof enclosure to prevent moisture damage. In no sense of the word can such prior art loudspeakers in bathrooms be considered as utilizing the structure of the fixture as an integral component piece or part of the loudspeaker itself. Such present systems can provide a pleasant sound environment, but offer nothing special over and above a sound

system in any other room or location. Moreover, such present systems can offer no treatment or therapeutic benefits.

## SUMMARY OF THE INVENTION

In accordance with an inventive arrangement, acoustic transducer drivers or sources are utilized to directly excite the surfaces of the bathroom fixtures. The bathroom fixtures become integral parts of the loudspeakers or other sources. The acoustic drivers or sources can include, without limitation, acoustic proof mass actuators (PMA's), and other electro-mechanical, Piezo electric, ribbon, electro-static, or other means of transduction to supply acoustical audio energy. The audio acoustical energy is transduced onto the surface of the bathroom fixture, so as to release sound energy through the fixture. The surface of the fixture becomes an audibly charged structural acoustic transducer. In practical terms, by coupling PMA's or other audio producing devices to the surface of a bathroom fixture, such as a bath tub, the fixture becomes a loudspeaker or the vibratory surface, such as a cone is to an electro-dynamic speaker.

In one embodiment, a system producing stereophonic high fidelity sound would couple at least two, (one for left signal, one for right signal) PMA's of full band audio (20 Hz-20 kHz) to the surface of the fixture. Audio signals transmitted through PMA transducers and the like produce an immersive, room filling, bath filling sound. In a bath tub, for example, the sound actually seems to be emanating from the surface of the water filling the bath tub. While one PMA would work for monophonic sound, at least two would allow stereophonic sound to be experienced by the listener positioned inside the fixture, for example, a bath tub or shower stall.

In addition to providing stereophonic music, the two PMA mounted devices can also provide low frequency vibrations to provide therapeutic massage therapy. This therapy can be varied, for example, using pulses, phase shifts, and series of ping pong effects from one PMA to the other PMA, and back, to oscillate the water, thereby creating various tonal and modal shifts to provide a plurality of effects and experiences, in addition to the music. For example, use of four or more acoustic sources around the perimeter of a bathtub can provide a whirlpool when a pulse signal is applied in a sequential manner to the series of sources.

Alternating a series of two way PMA's could be added to extend the frequency range and response, one providing low frequency sound, such as a woofer, and the other providing high frequency sound, such as a tweeter.

In accordance with another inventive arrangement, a plurality of oscillatory motors can be attached to the outer surface of the tub, for example by adhesive bonding. A control system can comprise a signal source, for example a CD player, which supplies a sound signal as an input to a real time spectrum analyzer. The output of the real time spectrum analyzer is an input to a switching matrix, which enables different ones of the motors according the frequency content of the sound signal from the signal source.

In a presently preferred embodiment, a transducer for coupling high frequency sound to a surface uses a combination of a Piezo Electret element coupled to a small metal or plastic rod attached between the center of the Piezo cone and the surface of the fixture, preferably being fixed to both. If the Piezo is too small, it can be attached to a fitting and the unit configuration becomes a High Frequency Structural Acoustic Transducer. The surface is thereby charged with structural high frequency vibrations.

Several methods can be employed for low frequency sound. A woofer could be attached to the surface of the fixture. However, in such a scheme, the fixture would have to be enclosed, as acoustic energy would not be concentrated onto the surface, but would radiate throughout the environment. Thus, in accordance with an inventive arrangement, a low frequency PMA is applied to the surface of the fixture. In a presently preferred embodiment, a transducer would be embodied in a loudspeaker with forward motion only, and a closed back, like that of a compression driver.

With the surface of the fixture and fittings now coupled to the acoustical audio transducers, standard audio amplifiers, or specially designed audio frequency responsive oscillatory amplifiers, or transformers could be used to connect the signal from a source to the PMA's. Housing for the electronics would of course be shielded from water.

An audio signal could be provided to the amplifier, such as a CD player, or radio. Also, a tone generator could be used as a secondary means for providing

audio signals. The tone generator would be used to set vibratory frequency ranges. In a presently preferred embodiment, a range would be from 18 Hz - 150 Hz for providing vibratory motion-induced massage, or other special effects. In addition, the generator could be set to provide various shaped modulations, such as a sawtooth, a square wave, or other modulation.

In addition to the tonal and modal audio waves, a combination of amplitude, phase pulses, time relayed cycling, spectral, spatial, temporal signal processing, and other methods can be employed to provide a plurality of whirlpool effects.

In addition to music signals and whirlpool effects, audio animation and sound effect techniques, such as wind rushing, a water fall, birds chirping, crickets, and the like can also be introduced. Audio animated sounds are different from sound effects. Sound effects are generally recordings of real things, whereas audio animation is created synthetically to provide an enhanced realization of a given sound. Objective stimuli is thereby more easily recognizable by the subjective mind. These could be used as a method for providing amusement, or as a practical means for replacing undesirable noise with desirable sound. It can also be used in balance with an automatic system by which bodily function sounds could be masked for enhancing privacy in public and private environments.

An entertainment and treatment system in accordance with an inventive arrangement, comprises: a fixture having a wall forming a reservoir adapted for holding a body of water, the wall having exterior and interior surfaces; a transducer mounted on the exterior surface of the wall and adapted for transmitting energy into the wall; and, an excitation source for energizing the transducer, the fixture forming an integral part of a loudspeaker in which the wall transmits vibrations responsive to operation of the transducer, the vibrations being emitted from the interior surface of the wall into the reservoir.

The system is preferably used with a body of water in the reservoir, the body of water having an upper surface defining a waterline. Some of the vibrations are in an audible range and some of the vibrations are below the audible range. The vibrations in the audible range are emitted from the interior surface of the wall above the water line, but being perceived as being emitted from the upper surface of the body of water. The vibrations below the audible frequency range are emitted from the

interior surface of the wall below the waterline and into the body of water, creating a massage action in the body of water.

The transducers can be mounted on the exterior surface of the wall, at levels below the waterline and above the waterline, singularly, in pairs and in larger numbers depending on the size of the wall and reservoir. Transducers mounted below the nominal waterline are preferably woofers and transducers mounted above the waterline are preferably tweeters.

The transducers can comprises proof mass actuators and Piezo electric elements.

Selectable sources for exciting the transducers can comprise: at least one audio source; and, at least one tone generator, having at least one frequency of not more than approximately 150 Hz.

Control means provide for independently selecting among the audio sources and among the tone generator frequencies; and, provide independent volume control of the selectable sources.

In accordance with another inventive arrangement, the system further comprises a plurality of the transducers, the transducers comprising oscillatory motors. A control system for the oscillatory motors comprises: a source of at least one sound signal having a frequency content; a real time spectrum analyzer responsive to the at least one sound signal; and, a switching matrix for selectively energizing the oscillatory motors responsive to the real time spectrum analyzer; different ones of the oscillatory motors being energized according the frequency content of the at least one sound single.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagrammatic view of a system configuration in accordance with an inventive arrangement.

Figure 2 is a perspective view of a main controller board in accordance with an inventive arrangement.

Figure 3 is an enlarged view of the keypad shown in Figure 1.

Figure 4 is an exploded view of a proof mass actuator in accordance with an inventive arrangement.

Figure 5 is a perspective view of a bathtub in accordance with an inventive arrangement.

Figure 6 is a perspective view of a bathtub in accordance with another inventive arrangement.

Figure 7 is an alternative embodiment of the inventive arrangement shown in Figure 6.

Figure 8 is a block diagram of a control system for the inventive arrangement shown in Figures 6 and 7.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The system 10 shown in Figure 1 comprises a power supply and amplifier 12, which receive AC mains power, an input/controller 14 and a keypad 16, which are connected by cables 11 and 13 as shown. A source 15 of an audio signal, for example from a CD player or a radio, is an input to controller 14. A cable 17 connects the input/controller to the various transducers and the like. The power supply is preferably operable from 110 VAC to 220 VAC and at 50 Hz to 60 Hz and can be, for example, a Stabylex S35 power supply. The power amplifier 12 can be a ZAPCO Z300 system, and the keypad 16 can be modeled after an Aerospa control pad and modified to provide the functions as disclosed.

A main controller board 20, shown in detail in Figure 2, is housed in the enclosure 14. All of the components are electrically and environmentally insulated, isolated and/or sealed, as necessary, and in accordance with known techniques and safety standards, to protect persons from electric shock and to protect the various components from water damage and the like.

The controller board 20 has, for example, ten sockets for receiving operating modules 21 through 30. The modules are in the form of circuit boards, which may be, for example, printed circuit boards. Module 21 is a mixer/controller unit. Module 22 is a low frequency generator, for example, providing an audio source including a tone generator and oscillator for the therapeutic vibrations. Other sound effects and animated audio effects are provided by modules 23 through 30. The modules are connected to a terminal strip 32. The various modules and effects can be embodied with known circuits.

The keypad 16 is shown in greater detail in Figure 3. The keypad 16 has an on/off button 40 and two sets of buttons 42 and 50. Set 44 controls the sound, having up/down button 44 for sound volume, up/down button 46 for sound effect and animation effect volume and up/down button 48 for selecting among the available sound effects and animation effects. Set 50 controls the swirl or vibratory effects, having an up/down button 52 for controlling the magnitude or volume of the swirl, or vibratory effects, and an up/down button 54 for selecting among the available swirl or vibratory effects.

A preferred proof mass actuator (PMA) arrangement 60 is shown in Figure 4. A mounting plate 66, for example of styrene, is affixed to an outer surface of a plumbing fixture, such as a tub, not shown. The mounting plate 66 has a groove 67 for receiving an O-ring seal 65. A housing 63, for example of styrene, is attached to the mounting plate, the interconnection being sealed by the O-ring 65. A Piezo electric crystal disk 62 is mounted in the housing 63, and is responsive to electric signals on wires dressed through holes 64. The housing is closed by a cap 61. A rigid sound post 68, for example aluminum, is affixed to the outer surface of the fixture and the facing surface of the Piezo electric disk 62, for example being adhesively attached to each. The sound post transmits the vibrations of the Piezo electric disk 62 directly to and through the wall of the fixture. A resilient silicone tube 69, for example about 1/4 inch in diameter, resiliently urges the sound post 68, through the Piezo electric element 62, against the outer surface of the fixture. An annular groove 70 on the inner surface of cap 61 seats the compression spring 69.

A bath tub 80 in accordance with an inventive arrangement is shown in Figure 5. The wall 82 of the bathtub 80 has an exterior surface 83 and an interior surface 84. The wall 82 forms a reservoir 85. The reservoir is adapted to hold a body of fluid 86, for example water, having a waterline 87. A plurality of PMA's mounted on the outer surface 83 of the tub are embodied as tweeters 88. A plurality of PMA's embodied as woofers 89 are also mounted on the exterior surface 83.

A mounting plate 90 made from plywood or the like is affixed to the outer wall surface, for example by adhesives. The mounting plate has a hole corresponding in size to the aperture of the loudspeaker housing 88. The loudspeaker housing is sealably attached to the mounting plate, so that the acoustic energy is

delivered directly into wall 82 through the hole in the mounting plate. The woofers 89 are preferably centered on opposite sides of the tub 80, at a level at or below the waterline 87. The tweeters 88 are preferably located two on each side, nearer the ends as shown, at a level above the waterline 87.

The tub in the illustrations is an IDEAL STANDARD COMBIFLUX, made from an acrylic material. The PMA low frequency acoustic drivers are Aura System AST2B-4 models, and the Piezo acoustic drivers are preferably Motorola Piezo Electrets.

The acoustic drivers are watertight in accordance with the IPX5 standard, a European standard, and have 500 V insulation per TÜV/CE requirements. The keypad must also be watertight in accordance with the IPX5 standard.

The vibrations from the transducers cause the wall 82 to vibrate. The transmission of audible sound, for example music or sound effects, is substantially blocked by the body of water 86. Accordingly, the audible sound is emitted into the interior of the reservoir 85 from that part of the interior surface 84 of the wall 82 above the waterline 87. Nevertheless, the sound is perceived as emanating from the surface of the body of water 86 at the waterline 87. Overall Piezo electric transducers are better suited for more rigid parts of the wall, whereas woofers are better suited for less rigid parts of the wall.

Lower frequency vibrations from the woofers, for example, near or below the lowest frequency at the typical audible range for humans, for example 150Hz or lower, are transmitted into and through the body of water 86, causing swirling and wave motion effects resulting in a massaging action.

The effect can be enhanced by another means for vibrating or exciting a surface, for example the surface of a bath tub, namely mechanical, oscillatory, or vibratory servo motors, or other mechanical means.

An example of this type of mechanically triggered device could be a servo motor, in a manner similar to a vibrating chair. An oscillatory transducer causes the surface of a chair to be vibrated, for example by exciting a coil.

A series of such motors, or oscillatory transducers, could be set up to be turned on and off in a pre-determined sequence, or act through a spectrum analyzer. An audio signal of varying frequencies can be sent through the analyzer, for turning

different lights on and off, according to which frequency is being applied and when. This is the principle underlying an "organ light". Instead of turning on a light indicator by frequency, a motor, or oscillatory transducer is turned on. The frequency which is played would determine which motor is turned on, and so forth.

As sound pressure levels vary dynamically, additional oscillatory transducers could be applied, or the intensity of vibration could be increased, or decreased in sympathy to the dynamics caused by sound pressure level fluctuations. Thus, a series of mechanical oscillatory servos, transducers, etc. could be applied to the surface of a bath-tub, or other surface, and using a spectrum analyzer, or other audio or acoustical measuring unit capable of any number of measurements, including, but not limited to, power balancing; spectral balancing; or spatial balancing, referenced to a motor per frequency, pressure, arrival time, etc. the motor can be triggered by said measurement to turn on and off as music, noise, or other sound and acoustic information is received.

The effect would be perceived a feeling the varying frequencies as one does in the proof mass actuation type embodiment. Although the motor driven units would not necessarily have audible sound, they would be possibly as noticeable, and under some circumstances, can be more efficient when combined with an audio transducer than a proof mass actuator.

A first embodiment of such a system is shown in Figure 6 and generally designated by reference numeral 100. A bathtub 102 has upper and lower fabric straps or strips 104 and 106 wrapped circumferentially around the tub in substantially horizontal planes. Each strap or strip of fabric has a plurality of oscillatory motors 108, or the like, attached thereto, for example by stitching. The straps can be attached by cinching the straps, and/or adhesive bonding or other suitable attachment means. The motors 108 can be attached individually, but the strap arrangement advantageously assures uniform spacing and provides a neat and safe carrier for the wires energizing the motors.

A second embodiment 110 is shown in Figure 7, wherein the bathtub 102 has straps or strips 112 and 114 arranged laterally, with respect to the longitudinal axis of the bathtub. These straps cannot be cinched around the tub, so that adhesive bonding

or the like is required. Alternatively, mounting hardware (not shown) can be provided on the bathtub, for example, adjacent to the underside of the rim.

A control system 120 for the embodiments of Figures 6 and 7 is shown in Figure 8. The output of a signal source 122, for example a CD player, is an input to a real time spectrum analyzer (RTA) 124. The output of the real time spectrum analyzer is an input to a switching matrix 126, which enables different ones of the motors 108 according the frequency content of the sound single from the signal source, in this case the CD player 122. Reference numeral 128 designates a common power terminal for the motors 108.

Loudspeakers for a toilet may be mounted, for example, on the walls of the tank and/or the bowl. Loudspeakers for a sink may be mounted, for example, on the sink bowl or, if present, a hollow supporting pedestal. In view of the rigid materials, Piezo electric transducers are preferred for these applications.

It should be appreciated that the difference between bath tubs, whirlpools, spas and swimming pools, when made from plastics materials, such as acrylics, fiberglass and the like, is primarily one of scale. The inventive arrangements taught herein can be scaled up in terms of the number of loudspeakers and acoustic driving power, to be implemented even in a swimming pool, if the pool is constructed from a suitable material.

We claim:

1. An entertainment and treatment system, comprising:

a fixture having a wall forming a reservoir adapted for holding a body of water, said wall having exterior and interior surfaces;

a transducer mounted on said exterior surface of said wall and adapted for transmitting energy into said wall; and,

an excitation source for energizing said transducer, said fixture forming an integral part of a loudspeaker in which said wall transmits vibrations responsive to operation of said transducer, said vibrations being emitted from said interior surface of said wall into said reservoir.

2. The system of claim 1, wherein at least some of said vibrations are in an audible frequency range and perceptible as sound inside said reservoir.

3. The system of claim 2, further comprising:

a body of water in said reservoir, said body of water having an upper surface defining a waterline; and,

said vibrations being emitted from said interior surface of said wall above said water line, but being perceived as being emitted from said upper surface of said body of water.

4. The system of claim 1, further comprising:

a body of water in said reservoir, said body of water having an upper surface defining a waterline;

at least some of said vibrations being below an audible frequency range; and,

said vibrations below said audible frequency range being emitted from said interior surface of said wall below said waterline and into said body of water, creating a massage action in said body of water.

5. The system of claim 1, further comprising:

a body of water in said reservoir, said body of water having an upper surface defining a waterline;

some of said vibrations being in an audible range and some of said vibrations being below said audible range;

said vibrations in said audible range being emitted from said interior surface of said wall above said water line, but being perceived as being emitted from said upper surface of said body of water; and,

said vibrations below said audible frequency range being emitted from said interior surface of said wall below said waterline and into said body of water, creating a massage action in said body of water.

6. The system of claim 1, wherein said fixture is a plumbing fixture.

7. The system of claim 1, further comprising:

a body of water in said reservoir, said body of water having an upper surface defining a waterline; and,

said transducer being mounted at a level below said waterline.

8. The system of claim 1, further comprising:

a body of water in said reservoir, said body of water having an upper surface defining a waterline; and,

said transducer being mounted at a level above said waterline.

9. The system of claim 1, further comprising:

a body of water in said reservoir, said body of water having an upper surface defining a waterline; and,

at least two transducers mounted on said exterior surface of said wall, one at a level below said waterline and another at a level above said waterline.

10. The system of claim 1,

a body of water in said reservoir, said body of water having an upper surface defining a waterline; and,

at least two pairs of transducers mounted on said exterior surface of said wall, one pair at a level below said waterline and another pair at a level above said waterline.

11. The system of claim 10, wherein said pair of transducers mounted below said nominal waterline are woofers and said pair of transducers mounted above said waterline are tweeters.

12. The system of claim 3, wherein said transducer comprises a proof mass actuator.

13. The system of claim 1, wherein said transducer comprises a Piezo electric element.

14. The system of claim 1, further comprising selectable sources of input signals for exciting said transducer.

15. The system of claim 11, wherein said selectable sources comprise:
at least one audio source; and,
at least one tone generator, having at least one frequency of not more than approximately 150 Hz.

16. The system of claim 15, comprising:
control means for independently selecting among said audio sources and among said tone generator frequencies; and,
control means for independent volume control of said selectable sources.

17. The system of claim 1, wherein said wall is a plastics material.

18. The system of claim 1, wherein said fixture is selected from the group consisting of bath tubs, toilets, sinks, spas, whirlpools and swimming pools.

19. The system of claim 1, further comprising a plurality of said transducers, said transducers comprising oscillatory motors.

20. The system of claim 29, further comprising:

a source of at least one sound signal having a frequency content;

a real time spectrum analyzer responsive to said at least one sound signal; and,

a switching matrix for selectively energizing said oscillatory motors responsive to said real time spectrum analyzer; different ones of said oscillatory motors being energized according said frequency content of said at least one sound single.

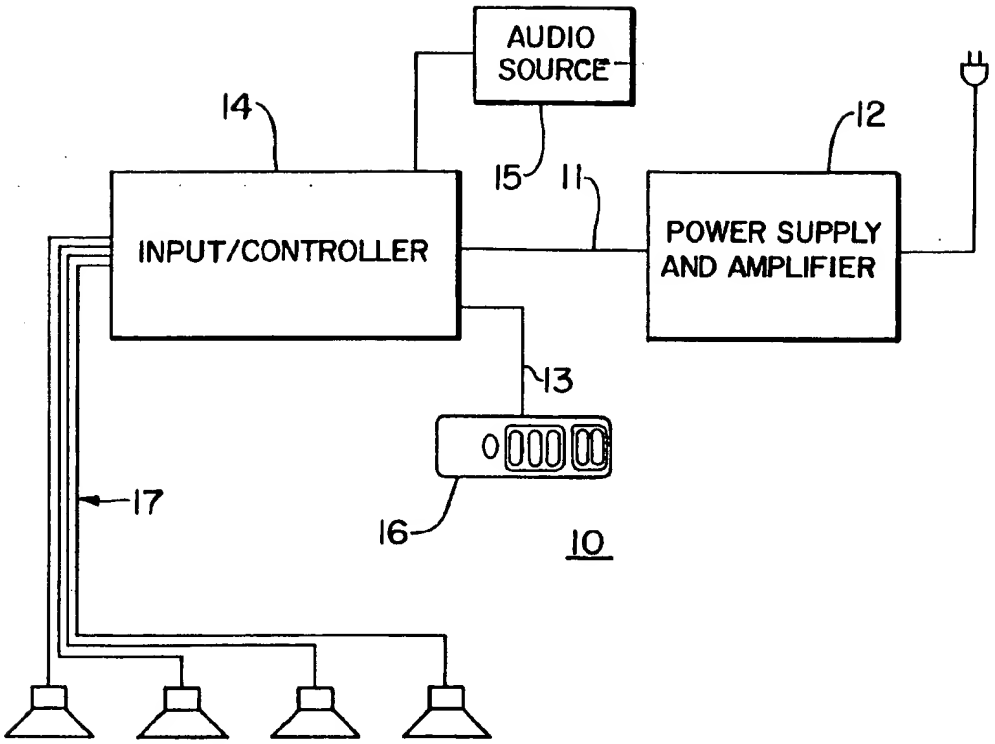
AUDIO SOURCE
14
15
11
12
INPUT/CONTROLLER
POWER SUPPLY AND AMPLIFIER
13
17
16
10

FIG. 1

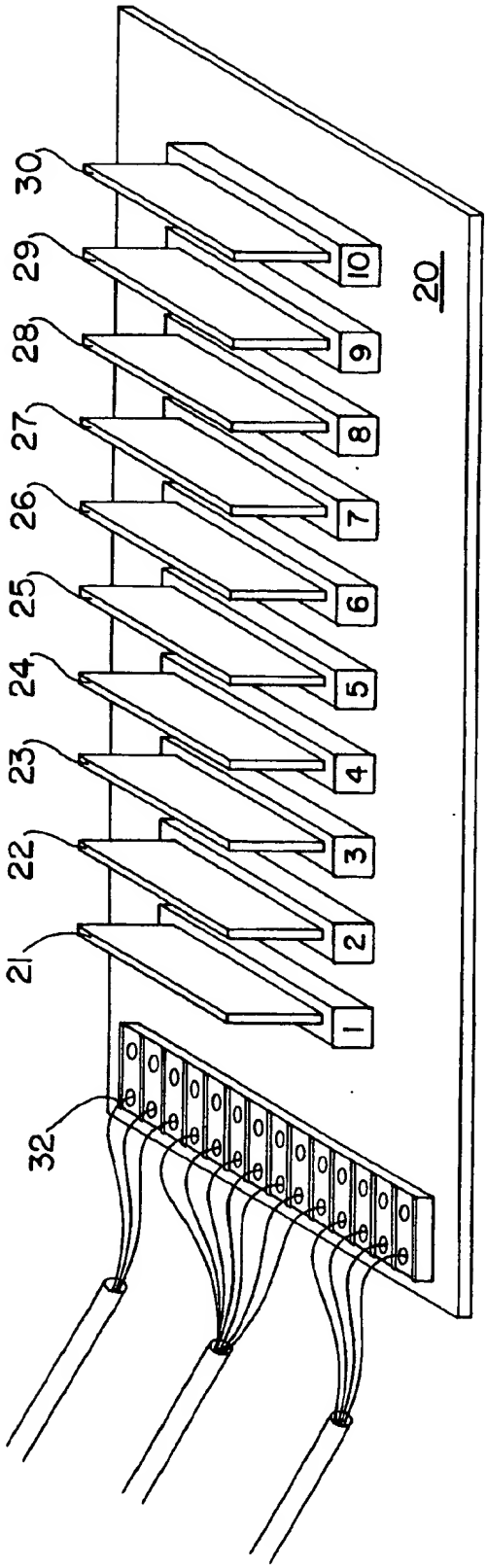


FIG. 2

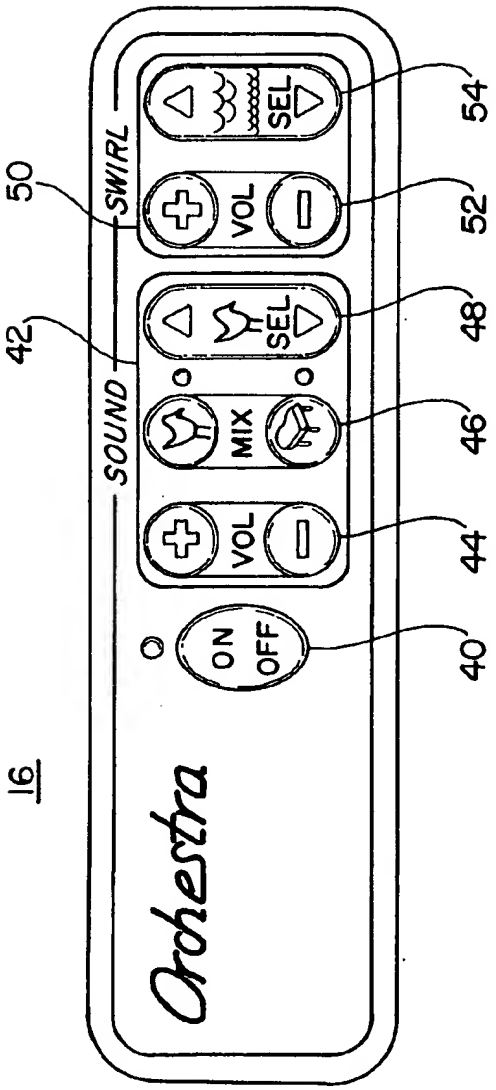
16
Orchestra
ON
OFF
40
SOUND
VOL
44
MIX
46
SEL
48
42
SWIRL
VOL
52
SEL
54
50

FIG. 3

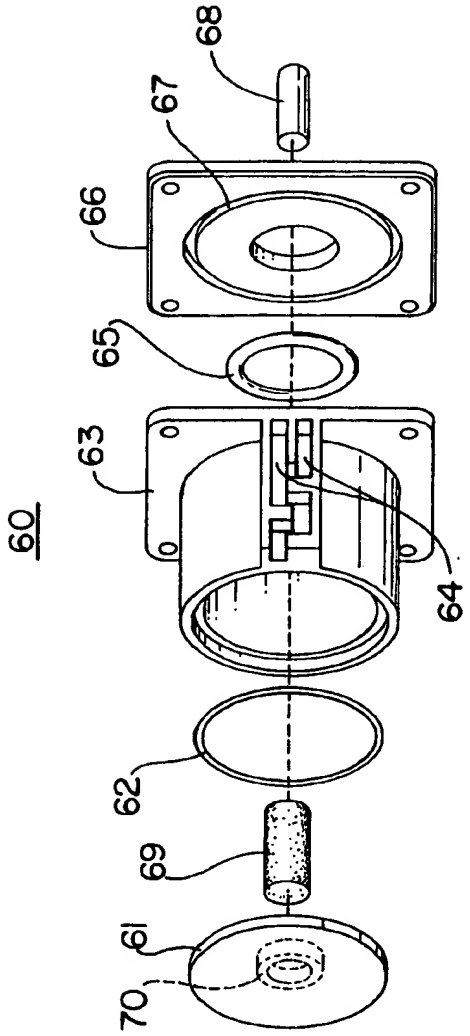


FIG. 4

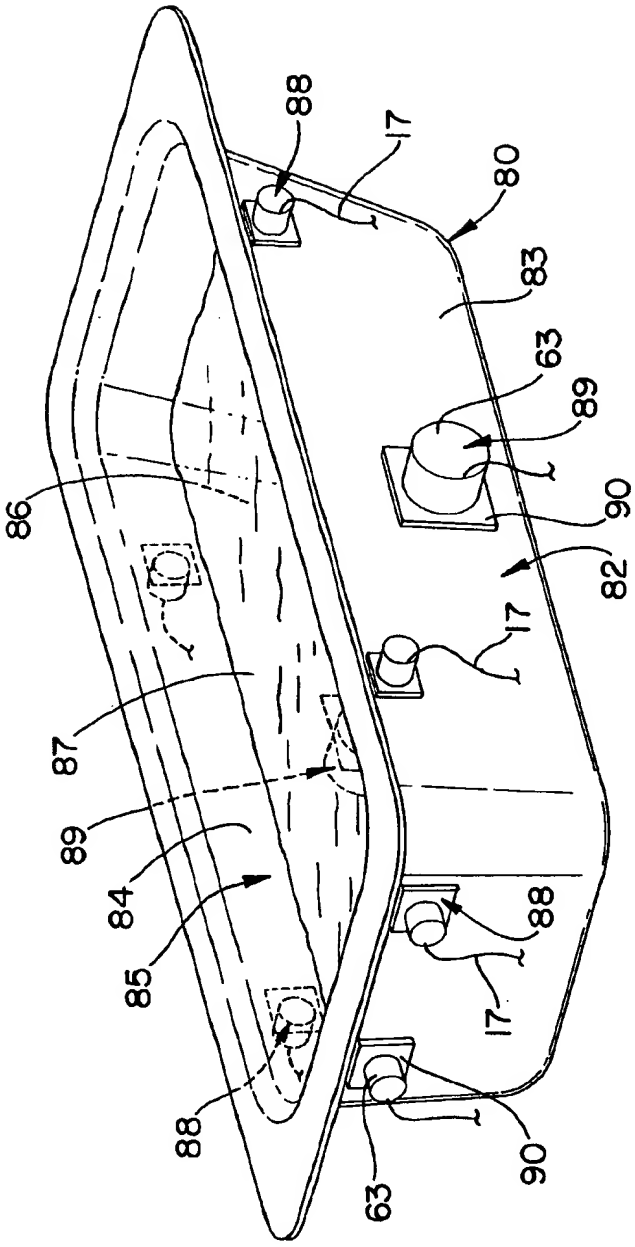


FIG. 5

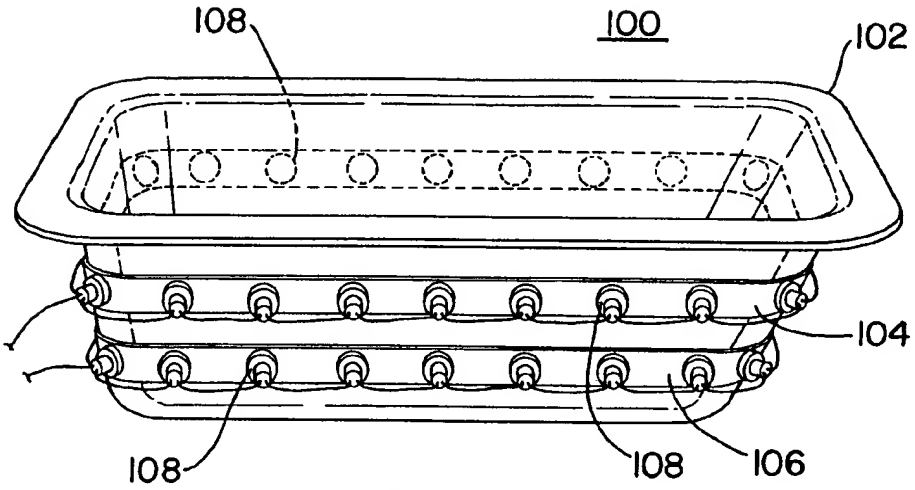


FIG. 6

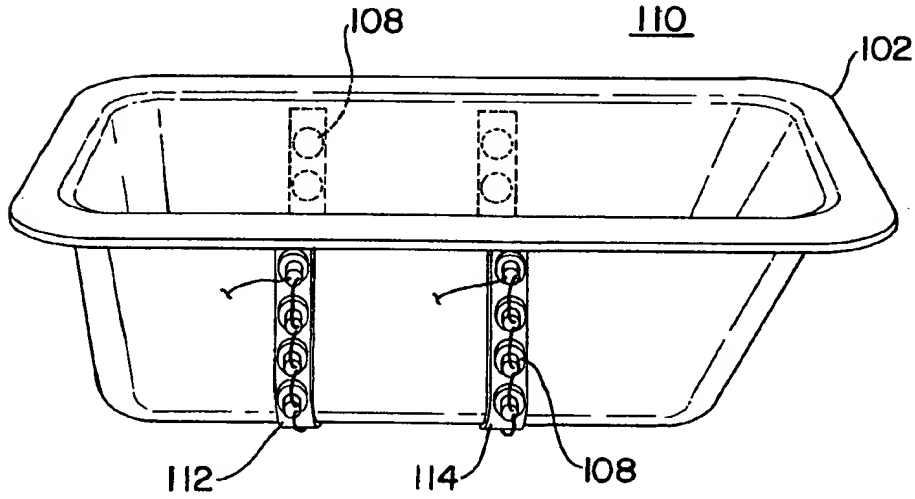


FIG. 7

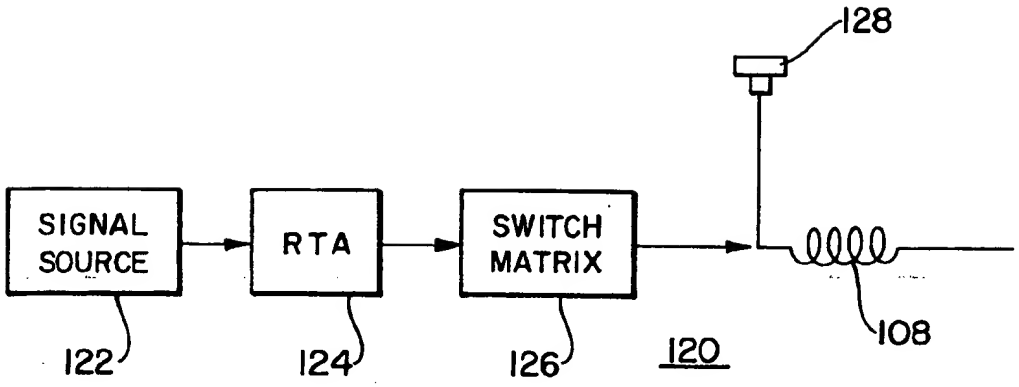


FIG. 8

# INTERNATIONAL SEARCH REPORT

| International application No. |
|---|
| PCT/US97/03710 |

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :A61H 1/00
US CL :601/47, 158

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 601/47, 48, 55, 154-158

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 3,585,991 A (Balamuth) 22 June 1971, see entire document | 1-20 |
| Y | US 4,575,882 A (diamond) 18 March 1986, see entire document | 1-20 |
| A | DE 3207892 A (Frenkel) SEPTEMBER 1983, see entire document | |
| A | US 4,757,548 A (Fenner) 12 July 1988, see entire document | |
| A | US 4,753,225 A (Vogel) 28 June 1988, see entire document | |
| A | US 4,237,562 A (DuPont) 9 December 1980, see entire document | |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

| | | | |
|---|---|---|---|
| * | Special categories of cited documents: | "T" | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
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| "O" | document referring to an oral disclosure, use, exhibition or other means | | |
| "P" | document published prior to the international filing date but later than the priority date claimed | | |

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 02 JUNE 1997 | 24 JUN 1997 |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. (703) 305-3230 | Authorized officer<br>DANTON DEMILLE<br>Telephone No. (703) 308-0858 |

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